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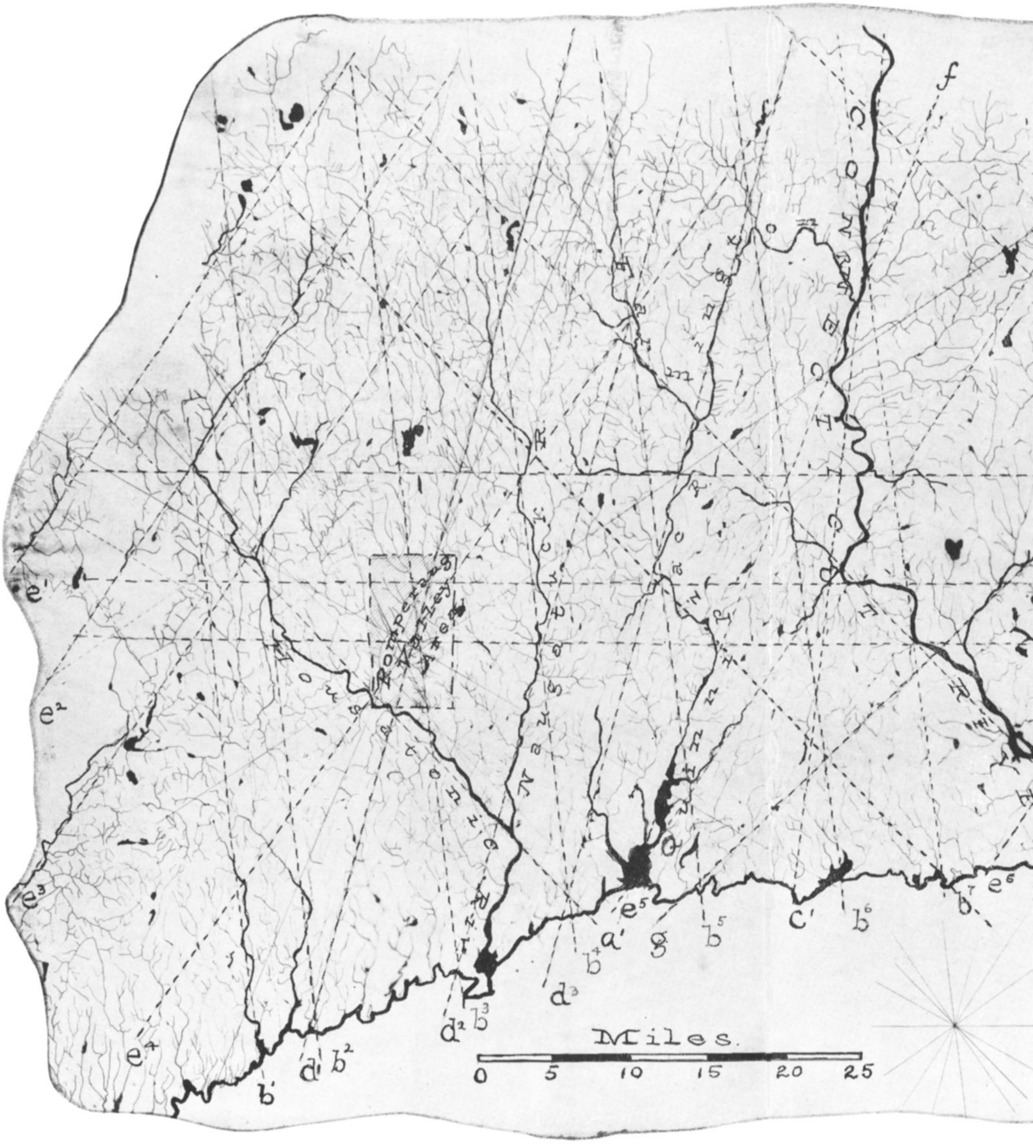


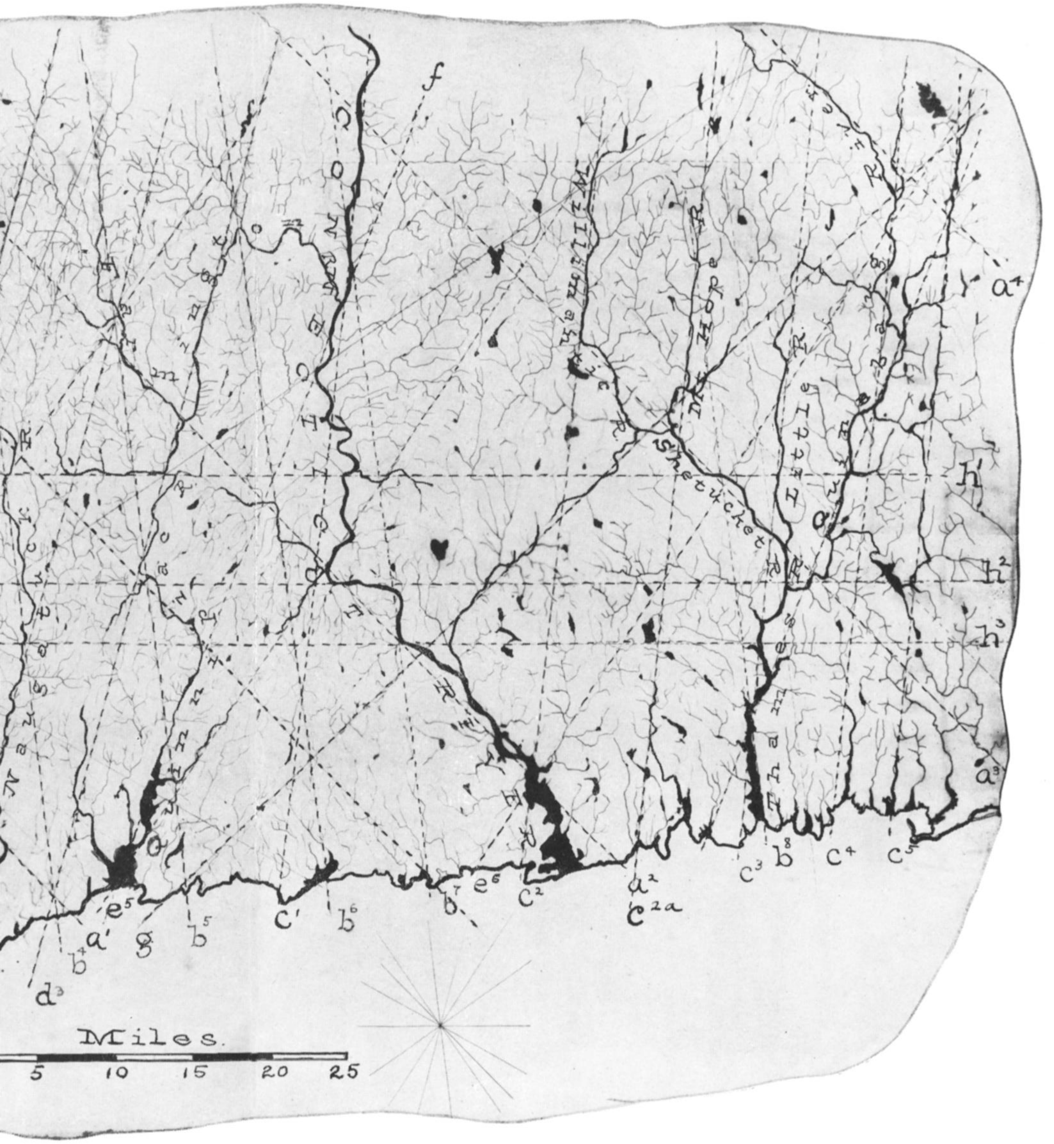
RIVER MAP OF CONNECTICUT

(Reduced from the two-sheet map of Connecticut by the U. S. Geological

The dotted lines indicate the prominent "trough lines," which trend as follows:

a^1, a^2, etc.,	N. 44° W.
b^1, b^2, etc.,	N. 5° W.
c^1, c^2, etc.,	N. 5° E.
d^1, d^2, etc.,	N. 15° E.
e^1, e^2, etc.,	N. 33° E.
f,	N. 20° E.

Plate I



RIVER MAP OF CONNECTICUT

d from the two-sheet map of Connecticut by the U. S. Geological Survey)

ough lines," which trend as follows:

c^2, etc.,	N. 5° E.	e^1, e^2, etc.,	N. 33° E.	g,	N. 48° E.
, d^2, etc.,	N. 15° E.	f,	N. 20° E.	h^1, h^2, etc.,	N. 90° E.W.

THE

JOURNAL OF GEOLOGY

SEPTEMBER-OCTOBER, 1901

THE RIVER SYSTEM OF CONNECTICUT[1]

THE tendency of the modern school of physiographers seems to be to ascribe little importance to geological structure planes as a factor in determining the position and the orientation of water courses. In an earlier period greater attention seems to have been accorded to this condition, and quite apart from the purely theoretical conceptions of the closet geologists many valuable observations were placed upon record. Th. Kjerulf, the former Director of the Geological Survey of Norway, remarked the regularity in the arrangement of fjords, streams, and valleys as represented upon the map of Norway, and from this was led to believe that their directions corresponded to the faults in a system of dislocations. Daubrée[2] has furnished many examples of regular networks of stream channels which resemble the network produced by a number of intersecting series of parallel joint planes (*réseaux réguliers de cassures*), and the explanation of this correspondence he believed to be a causal one, the planes of separation, or jointing, being locally gaping where the streams adhere to the joint direction, but closed where they have been diverted from the course of the joint. Van Hise[3] has in a similiar way explained the zigzags of the small streams which enter the Wisconsin River at the "Dells" as due to a system of joints induced by the gentle folding of the rocks. That a more or less uniform system of joints exists in the rocks almost throughout the state of Wisconsin has been shown by Buckley's observations.[1]

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[1] Published with the permission of the Director of the U. S. Geological Survey.

[2] DAUBRÉE: Géologie Experimentale. Paris, 1879, p. 361.

[3] VAN HISE: Trans. Wis. Acad. Sci., etc., Vol. X., pp. 556-560, 1895.

So far as the writer is aware, the only detailed studies that have been made establishing the definite relationship of the stream channels of a region to its system of joints or faults, are those of Brögger[2] in the Langesund-Skien and Christiania regions of southern Norway, and that of the writer[3] in the Pomperaug Valley region of Connecticut. Of the elaborately faulted region which Brögger has studied, he states:

> It is not exaggerated when to my own astonishment I must state, as the final result of my observations in this region, that almost every valley, every cleft, is formed along a fault fissure. . . . . The significance of the faults for the formation of the valley straits is thus as profound as possible within the stretch of land described, since almost every cliff, every vale, every bay has been formed upon a line of dislocation; indeed the presence of clefts was for me, at the last, the surest index for the discovery of dislocations.[4] [Translation.]

Review of the geological structure of the Pomperaug Valley area of Connecticut.—Regarding the Connecticut area to which reference is made, it will be necessary here to review the study in order to make clear the generalizations with which this paper is especially concerned. It is now well known that the several areas of Newark rocks of the eastern United States are complexly faulted, and the many common structural peculiarities of the several isolated areas give rise to the belief that the forces which have produced the dislocations have affected, not the Newark rocks alone, but the larger region of which they are parts—the Piedmont plateau of the eastern United States.[5]

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[1] BUCKLEY: Bull. 4, Geol and Nat. Hist. Surv. Wis., pp. 450–460, 1898.

[2] BRÖGGER: Nyt Magazin for Naturvidenskaberne, Vol. XXVIII, pp. 253–419, 1884. *Ibid.*, Vol. XXX, pp. 99–231, 1886.

[3] HOBBS: Twenty-first Ann. Rept. U. S. Geol. Surv., Pt. III, 1901, pp. 1–162.

[4] Op. cit., pp. 34, 342.

[5] Cf. DAVIS: The Triassic Formation of Connecticut, Seventh Ann. Rept. U. S. Geol. Surv., 1888, pp. 481–490.

The detailed study of the Pomperaug Valley area has developed the fact that a complex system made up of intersecting series of parallel nearly vertical joints and faults there divides the crust into a large number of orographic blocks, the smaller of which have dimensions of less than one hundred paces. The different throws along the numerous faults bounding these blocks have brought about a structure not unlike that of a mosaic from which the supporting base has been lowered and the individual stones been displaced by different amounts due to the inequalities of their lateral support. For the area as a whole, the joints and corresponding faults are embraced mainly in four series, the individual members in which trend N. ± 34° W., N. ± 55° E., N. ± 5° W., and N. ± 15 E. Series of faults less common for the area as a whole, but several of them numerous enough in its southern portions, have directions N. ± 33° E., N. ± 44° W., N. ± 61° W., N. ± 90° E. W., N. ± 20° E., and N. ± 25° W., the order being approximately that of frequency of occurrence. Of the more common series, those trending N. ± 55° E. and N. ± 34° W. are nearly normal to one another, as would be true of a pair of joint planes, but the larger throws within the region seem generally to have taken place along one of these planes (N. ± 55° E.) and one of the other prevailing directions (N. ± 5° W.). Aside from the regularity in direction observed to characterize the numerous faults and bring them into a number of parallel series, those faults of the same order of displacement are observed to be spaced also with noteworthy regularity. The smallest of the orographic blocks which could be measured, for convenience called the "unit" blocks, were found to be quite generally about 50 paces (150 feet) along the direction N. ± 55°E., and 100 paces (300 feet) along the direction N. ± 5° W.—the equivalent of two rhombic prisms in contact along one side. The larger, or "composite" blocks, which are of various orders of magnitude, are made up of the "unit" blocks and bordered by displacements of a higher order—greater throw. The fault intervals in the several series, and hence the shapes of the orographic blocks, are found to be closely related to the directions of the prevailing and rarer fault series in a manner which is made clear by the diagram of Fig. 1. In this figure the shape of the unit orographic block—and of many composite blocks of several orders as well—is shown by the black and also by the stippled area. Two of the prevailing fault directions, N. ± 15° E. and N. ± 34° W. correspond to the longer and the shorter diagonals respectively of this unit block. The fault direction N. ± 33° E., which is the most common of those occurring in the southern Pomperaug area, corresponds closely to the longer diagonal of three unit blocks in contact along their longer side. Another of the series of faults characteristic of the same southern area and trending N. ± 20° E., corresponds to the longer diagonal of six unit blocks, two composite blocks like those just described placed in contact along their longer sides. The remaining directions of faults observed in the area are respectively the shorter diagonals of composite blocks three units long and two wide, four long and six wide, four long and seven wide, and two long and seven wide; though clearly in these latter instances, the relationships indicated in the diagram are less significant owing to the more complex nature of the composite blocks of which the fault directions are the diagonals. For a more important indication of the same relationship, which is observed in the actual composite blocks of the area studied, the reader must be referred to the original report.[1]

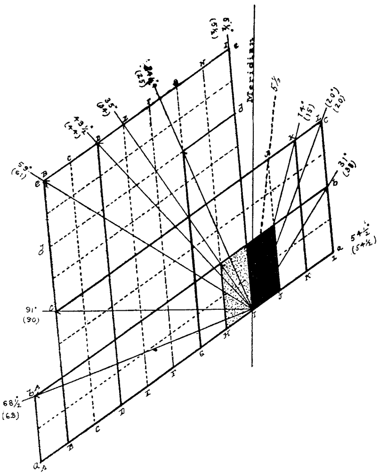

FIG. 1.—Diagram to illustrate the relationships existing between the shape of the "unit" orographic blocks and the directions of the fault series.

For the area in question the conclusion has been drawn that the earth's crust has been here subjected to compressive stresses, the resultant of which acted in a direction normal to the axis of Green Mountain folding (N. ± 80° W.), stresses which were relieved by dislocation along the planes of maximum shear, approximately 45° to either side of the direction of pressure, *i. e.*, S. ± 55° W. (N. ± 55° E.) and N. ± 34° W. The remaining common directions of fault planes (N. ± 15° E. and N. ± 5° W.) could be explained by a subsequent development of compressive stress acting along the initial direction; for in a region containing planes of separation at 45° to the direction of pressure, there would be a resolution of the stress into components acting along the planes of separation and along that diagonal of the blocks which is nearly normal to the pressure. The direction N. ± 15° E. corresponds to this diagonal of the joint block already formed, and the remaining direction N. ± 5° W. is the corresponding diagonal of two such blocks in contact. To explain these latter dislocations upon the same principle, it must be assumed that, owing to differences between the alternate joint planes of the same series, these double joint blocks acted to some extent as units. The fault directions characteristic especially of the southern portion of the area and disclosing such intimate relationships to the four generally prevalent ones, might be explained either by assuming that in the later compression of the jointed area composite blocks of different shapes, because composed of a different number or different arrangement of unit blocks, acted as units (whether due to the greater perfection of their bounding fault planes over intermediate ones, to the partial closing or healing of the intermediate faults, or to some other cause). In this case the maximum shear would be along the diagonal of the composite blocks, as would be the case in the unit blocks themselves, and it is shown in the report under review that these directions do correspond, *not only in direction, but also in position* with the diagonals of important composite blocks of the area. Under certain conditions, which may or may not have obtained in the area, planes of dislocation having the same directions might have been produced through the depression of the composite blocks subsequent to the jointing of the area, since in this case also the tendency would be for blocks to rupture along the diagonals.

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[1] Loc. cit. pp. 117–120.

The oriented drainage of the Pomperaug Valley.—With this brief summary of the geological structure within the Pomperaug Valley area we may consider its drainage. It was found in studying the area that the streams, large and small, for considerable distances adhere with great fidelity to the directions of some of the prevailing faults, and that in many cases after being diverted from them, it was noted that they had returned persistently to the old direction. This correspondence of drainage lines to geological structure planes is far too close to be accidental. The four prevailing fault series diverge from their nearest neighbors at angles of about 39°, 20°, 29°, and 92°. A difference in angle between a fault direction and the general direction of a stream course equivalent to 7°, or about one third the smallest difference of angle between neighboring fault directions, would represent a divergence of one in eight, which would hardly be accepted by the eye as an indication of parallelism. It is not to be expected that the actual course of a stream will now be coincident with or even absolutely parallel to any fault direction, for there have unquestionably been many local conditions which have produced larger or smaller migrations of the river channels. Their general direction has, however, it would seem, been maintained despite the minor accidents which have marked their life-histories, and even under so revolutionary a change as complete reversal of drainage.

It was further shown in the investigation under review, that in the walls of crystalline rocks surrounding the Newark beds in the Pomperaug basin, the same adhesion of the water courses to the direction of the observed faults (extended) could be determined. It was hardly to be expected that these peculiarities would cease to be observable so soon as the immediate vicinity of the Newark basin was left behind, if it be indeed true that the dislocation of the area is due to a compression of the general region in which this area of Newark rocks and the much larger one of the Connecticut valley are included. Owing, however, to the absence over the greater part of the surrounding area of widely different rocks in thin beds, the difficulties of locating fault planes are almost infinitely increased; and, indeed, except under especially fortuitous conditions they elude observation. Having established, however, a relationship in one area, the problem is before us to determine whether the river system of the larger area of Connecticut exhibits any indication of the existence of rectilinear directions more or less persistent embraced in a network of parallel series like that of the Pomperaug Valley; or, if this be not true, whether any other persistent and recurrent directions can be observed. It will be further of special interest if such a system affords indication of a regular space-interval between such parallel lines of drainage.

The oriented drainage of the Shepaug River.— In prosecuting our inquiry regarding the orientation of the drainage lines of Connecticut, the valley of the Shepaug River (its southern portion) was first examined, since this basin immediately adjoins to the west that of the Pomperaug. The diagram of this river traced from the atlas sheet of the map of Connecticut, prepared by the topographic corps of the United States Geological Survey (Fig. 2), affords clear evidence that the geological structure planes have here played an important part in giving direction to the river's channels. The dotted lines of the figure show the inferred approximate positions of fault planes whose course the river has adopted. The most marked adhesion of the river or its

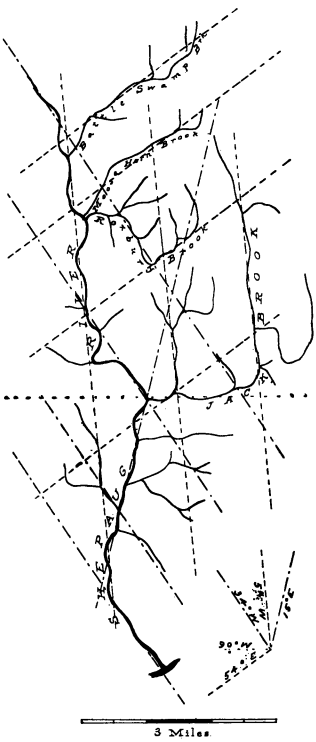
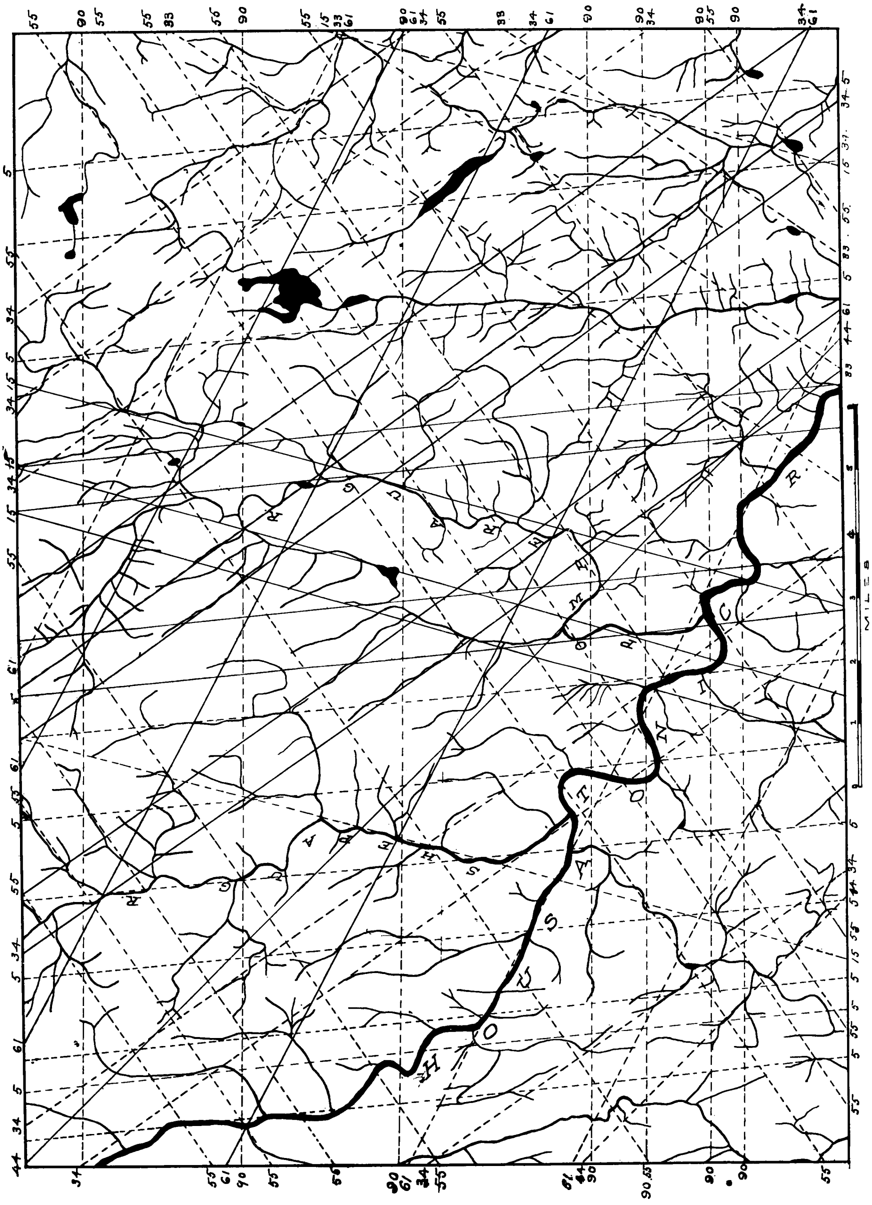


FIG. 2.— Diagram to show the relationship of drainage lines in the basin of the Shepaug River to the prevalent fault and joint lines of the neighboring Pomperaug basin.

branches to any given direction is very closely the direction N. 5° W., as shown by the upper course (in the diagram) of the trunk stream, as well as by the upper course of Jack Brook, its main eastern tributary, and by the small intermediate branch of the latter. These three channels are not only evenly spaced, but to the southward their extensions correspond in position with the southerly trending elements of great elbows of the Housatonic (see Plate II). After receiving the waters of Jack Brook, the Shepaug flows for nearly three miles in the direction S. ± 15° W. (N. ± 15° E.), another of the four prevailing fault directions observed in the Pomperaug Valley. Later it flows S. ± 34° E. (N. ± 34° W), while several tributaries flow along this direction and S. ± 55° W. (N. ± 55° E.), the two remaining of the four prevalent fault directions of the Pomperaug Valley.

The oriented drainage within the area surrounding the Pomperaug Valley.— In the map of Plate II, a larger area, of which the Pomperaug Valley is the center, has been considered. Upon this map, traced from the United States Geological Survey atlas sheets, which are on a scale of one inch to the mile, the full straight lines represent observed faults (extended), and the dotted lines the inferred approximate position of faults. It has, of course, been necessary to omit all but a few of the numerous faults which were observed in the Pomperaug Valley area. The figures on the margin of the map indicate the directions (in degrees) either to the east or west of north of the trough or fault lines which emerge near them. With the greater complexity of this map and the larger number of fault directions represented, relationships are not at once so apparent as in Fig. 2, which upon a reduced scale is here included. Special attention is directed, however, to the fact that the Housatonic itself, which after flowing about three miles in a direction S. ± 5° E. (N. ± 5° W.), assumes the direction S. ± 61° E. (N. ± 61° W.) at first in a nearly straight channel for three miles, and then in a zigzag course for eight miles more. Many interesting peculiarities will be noticed in the orientation of the smaller streams shown upon this map; as, for example, along the N. ± 55° E.



RIVER MAP OF THE AREA SURROUNDING THE POMPERAUG VALLEY

The full lines are observed faults of the Pomperaug Valley area (extended); the dotted lines are "trough lines" (inferred approximate positions of joint or fault planes); the figures on the margin give the angle in degrees to the east or west of the meridian of the "trough lines" which pass near them.

line which approximates to a diagonal of the map, along the N. ± 33° E. line which meets the lower margin of the map near where the Housatonic meets it, etc. It will hardly escape notice, also, that the most marked lines in each series are spaced with considerable regularity, and if one space is wider than the others, it is often so much wider as to suggest that the space-interval is a multiple of the space which has been regarded temporarily as the unit.

The river system of Connecticut.— An examination of the larger area approximately coëxtensive with that of the state of Connecticut has been made by use of the "two-sheet map of Connecticut," on a scale of one half inch to the mile, prepared by the United States Geological Survey Those lines and characters of this map, such as topography and culture, with which we are not now concerned and which would obscure the relationships sought, were eliminated by preparing a careful tracing of all the streams and their minor branches. Upon this map tracing (about six feet long by four wide) approximately rectilinear stretches of river channel, and especially the stretches of neighboring streams which hold approximately to the same line, were sought. If these directions were found to agree closely with any of the fault directions observed in the Pomperaug basin, dotted lines were drawn following those directions and coinciding as closely as possible with the river courses. If such an observed direction was found not to coincide closely with any of the fault directions determined, a direction was sought which would approximate most closely to it, and a similar dotted line with this direction drawn along the course of the river. The term "trough lines" used to designate these lines, need for the present be given no further signification than lines so favored by nature that the waters of the region have been induced to adopt them for their channels over longer or shorter distances. On a map of this scale the trough lines, if rectilinear, should be slightly curved, but inasmuch as the present river courses, because of the many accidents of their history, can only roughly approximate to the direction initially given them, it would be an over-refinement to introduce a correction of this nature, and they are, therefore, left straight. When all important trough lines had been thus represented, the map was reduced by photography and the etching of Plate I produced after the important rivers had been made a little heavier in order that their course might be apparent. These details of the study have been noted because the dangers of introducing the personal element while drawing the course of a river with any theory of its orientation in mind are very great. The map conveys a wrong impression, therefore, chiefly in its slightly exaggerating the volume of certain streams which it was necessary to draw with heavier lines in order that their correspondences might be apparent.

The first trough lines to impress the observer are those designated a_1, a_2, a_3, a_4, upon the map, lines which trend approximately N. 44° W., and which include the lower reaches of the Housatonic, of the Connecticut below Middletown, of the lower Willimantic and the Shetucket, and a stretch of the Quinebaug. A less-marked trough line between a_1 and a_2, would include important bends of the Naugatuck and Quinnipiac rivers. The sharp bend of the Connecticut River at Springfield and Patchoug River, tributary to the Quinebaug, may indicate the course of another trough line in this series. Most noteworthy of all lines in this series, however, is a_2, since the lower stretch of the Connecticut (some twenty-five miles long) is continued in the zigzag Sebethe River, so as almost to connect with the stretch of the Farmington River above its sharpest bend at Farmington. The direction of the lower stretch of the Connecticut is of especial interest because the river at Middletown deserts the softer Newark sediments to flow across the crystalline uplands, a peculiarity which has been explained by Professor Davis[1] through conformable superimposition, the stream being supposed powerful enough to maintain an initial course along this direction during the rise of the uplands, at which time the harder gneisses were discovered. The same hypothesis has been offered by Kümmel[2] to explain the lower course of the Housatonic, which similarly deserts the limestone to cross the uplands. The presence of important structure planes in these positions would, in the view of the writer, afford the simpler explanation. It will be noted here that there is considerable uniformity in the spacing of the trough lines of this series, especially a_2, a_3, a_4.

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[1] DAVIS: The Triassic Formation of Connecticut, Eighteenth Ann. Rep. U. S. Geol. Surv., Pt. II, 1898, p. 165.

[2] KÜMMEL: Some Rivers of Connecticut, JOUR. GEOL., Vol. I, p. 379, 1893.

The next most striking series of trough lines is indicated in the course of the Connecticut from Springfield to Hartford (c_1), a distance of twenty-six miles; of the Willimantic (c_2); of the Mt. Hope (c_{2a}); the Little (c_3); and a long stretch of the Quinebaug (c_4). The direction of these trough lines is about N. 5° E., though this is not one of those observed to characterize the faults in the Pomperaug Valley area. Again, the spacing of these trough lines is quite regular if we regard the space between the Connecticut and the Willimantic as a double interval. More striking, perhaps, than any of these trough lines is the one indicated in the series of smaller streams which extend along the line c_5 of the map. These streams are too small to deserve names upon a map of this scale, but some of them are known as Five-Mile River, Whetstone Brook, Moosup River, Mt. Misery Brook, etc. The direction of the series was in fact obtained from them and applied to the other trough lines in the series. This direction, while not an observed fault direction, corresponds to the longer diagonal of two unit orographic blocks of the Pomperaug Valley placed in contact along their shorter sides (see the dotted diagonal in Fig. 1), and thus it fills an important gap in the system of dislocations outlined.

The trough lines d_1, d_2, and d_3, which trend N. ± 15° E., represent a third series. The line d_1, which corresponds in position with no very important stream, is an observed fault of the Pomperaug Valley area (extended), in which area, however, the Pomperaug River adheres closely to its direction; d_2 corresponds closely for a distance of about fifteen miles with the course of the lower Naugatuck; while to the south the lower Housatonic flows in a nearly parallel direction some distance farther to the east. Most striking of this series is the trough line d_3, along which are arranged stretches of the West, the Quinnipiac with its tributary the Ten-Mile, the Farmington with its tributary the Pequabuck (for about fifteen miles), and a minor branch of the Farmington, which enters at its last great bend. This line, except near New Haven, is some distance east of the curving western boundary of the Newark area of the Connecticut valley.

The only important fault line observed to hold to the direction of the N. ± 20° E. faults, which is marked f on the map, follows the Quinnipiac for about fifteen miles and continued northward coincides with the course of the Connecticut for a distance of about six miles.

Following the direction N. ± 33° E. are the trough lines e_1, e_2, e_3, e_4, e_5, and e_6, the latter less marked than the others, and e_4 being an important observed fault in the Pomperaug Valley area. The line e_2 follows for a distance of fifteen miles or more, the middle course of the Housatonic; e_3 is nearly in line with the Croton and the Aspetuck rivers; while e_5 is outlined by the Pine River and the small branch of the Connecticut, which is continuous with the southwesterly flowing elbow of that river at Middletown. The line e_6 shows no striking correspondences on a map of this scale, though midway between it and e_5 the Salmon River, a branch of the Connecticut, for about seven miles follows the direction closely.

The trough lines of the N. ± 5° W. series (b_1, b_2, b_3, etc.), while not prominently marked by the courses of any great streams, save for short distances by the Housatonic, the Naugatuck, and the Connecticut, yet all show on a larger scale map in the minor stream branches many interesting correspondences. As this direction agrees more or less closely with the slope of the Cretaceous plain of erosion of southern New England, the failure of the strong streams to follow this direction is worthy of note.

Though less marked than some of the other series, the trough lines which trend N. ± 90° E. W. seem to be clearly outlined, especially h_1, which passes through the divide of the

Farmington and Quinnipiac at Plainville, and h_2, which follows the easterly course of the Connecticut for a distance below Middletown.

A trough line seems to be indicated in the Salmon River and a branch of the Willimantic (g). This direction is N. 48° E. and does not correspond to any observed fault direction in the Pomperaug Valley area. Neither is it the diagonal of any very simple composite block of that area, which otherwise might indicate its relationship to this system.

Conclusions.—In conclusion it may be stated that the rivers of Connecticut seem to indicate by the orientation of their channels the existence of a regular network composed of a number of intersecting series of parallel lines, which for lack of a better term have been designated *trough lines;* and, further, that with two exceptions the more important of these trough lines correspond closely in direction with the directions of fault series observed to characterize the complexly faulted area of Newark rocks in the Pomperaug Valley. Of the two exceptions to the rule, the more noteworthy one (N. ± 5° E.) fills an important gap in the system of faults determined for that area. This study is therefore in its bearing a confirmation of the conclusions arrived at by Kjerulf, Daubrée, and Brögger, who have seen in the orientation of water courses the strong directing influence of geological structure planes.

There are obviously a number of ways in which the dislocations of a region, like the one under consideration, might be made to account for the orientation of stream courses. The direction of streams by the joint or fault planes themselves may be competent to explain the network indicated, more particularly if the streams began their cutting in the soft Newark sediments, which easily sustain secondary fractures near fault planes. That some voids occur along the fault planes of the Pomperaug Valley would seem to be indicated by the fact that these planes have conducted the underground waters to the surface at so many places within the area of the Newark rocks. Tension joints should, however, be more effective than compression joints in the control of drainage lines, if it be assumed with Daubrée that the gaping fissure planes have directed the streams in their courses. The presumptive evidence is, the writer believes, in favor of the former development of the Newark rocks over a much larger territory than that which they now occupy and probably over the entire state of Connecticut.

It is an observation of much interest that the minor twig-like branches of the streams, which in the deeply eroded mass of crystallines must have been adjusted after the capping of sandstones had been removed, show an equally strong tendency with the master streams to follow the special directions indicated by the system as a whole.[1]

The study of the fault system of the Pomperaug Basin offers, however, another rational and natural explanation of the network of streams, provided the assumption is made that the drainage is adjusted to that formed in the geographic cycle which succeeded the deformation of the area. The system of parallel faults has divided the area into vertical triangular, rhombic, or rhomboidal prisms, which stand at different relative altitudes. These prisms are found to be grouped into composite blocks of increasingly higher orders, the peculiar property of each of which is that the average altitude of its component prisms approximates (however roughly) to a fixed value—the composite blocks have an average level surface, although alternate prisms or alternate subordinate blocks for short distances project above or stand below the general level. The initial surface formed by these prisms would be marked by canal-like structure trenches (*Graben*) which follow the directions of fault planes and which have stronger directive power, as regards streams, at the junction of the trenches and at the crossings with the similar trenches of other series.

Although the numerous generally curving fault planes discovered by Davis in his extensive studies of the Newark of the Connecticut valley have here been omitted from consideration, for the reason that no close relationship to the orientation of streams is apparent in their directions, there is no intention thereby to minimize the importance of those studies. The investigation of the smaller Newark area of Connecticut, which by contrast was almost microscopic in its detail, brought out a series of facts which for their interpretation required a totally different theory from the one to which Professor Davis was led by his studies. The two hypotheses have, however, this in common, that the primary cause of the deformation in the Newark rocks is assumed to be the compression of the crust within the area of southern New England by a force of compression, the resultant of which acted in a direction W. N. W. to E. S. E.

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[1] Twenty-first Ann. Rept. U. S. Geol. Surv., Pt. III, p. 145, Fig. 52.

The present writer has been led to the conclusion that the courses of large faults within this general area, if not approximately rectilinear, are in reality zigzags, the elements of which are essentially right lines, examples of this kind being by no means rare in, and, in fact, generally characteristic of, the Pomperaug Valley. It is not impossible that many of the larger faults described by Professor Davis, if examined in greater detail, might show this peculiarity, and perhaps also fall into the system which has here and elsewhere been elaborated. The numerous broken lines which are so apparent in the boundaries of the trap hills of the Connecticut valley, as represented on the topographic atlas sheets (*e. g.*, Meriden sheet), would seem to favor this view. It is in any case important, as it would seem to the writer, to consider in two stages the dislocations brought about mainly by a lateral compression of a section of the earth's crust, inasmuch as jointing (the production of planes of separation) is in these cases a necessary prerequisite to faulting (displacement along planes of separation). The modern views of geologists concerning joint planes produced by the shear from lateral compressive stresses are now sufficiently in accord to assume that vertical block faulting takes place along ready-formed planes of jointing. In his description of the faulted area of southern Norway, Brögger[1] has been careful to make this distinction.

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[1] Loc. cit.

With the explanation of the numerous diversions of rivers from their rectilinear stretches this paper is not especially concerned, although some explanation of such diversions could be found in the peculiarities of a region faulted like that of the Pomperaug Valley. The modern criteria of the physiographer deal adequately with this matter. It is the definite orientation of water courses which the new science seems to have neglected.

WILLIAM HERBERT HOBBS.